



EPA Region 7 TMDL Review

TMDL ID: MO-2835 **Water Body ID:** MO-2835
Water Body Name: St. Francis River
Tributary: St. Francis River
Pollutant: Biochemical Oxygen Demand(BOD) and Ammonia
State: Missouri **HUC:** 8020202-010003
BASIN: Upper St. Francis Watershed
Submittal Date: December 28, 2005
Approved: YES

Submittal Letter

State submittal letter indicates final TMDL(s) for specific pollutant(s)/water(s) were adopted by the state, and submitted to EPA for approval under section 303(d) of the Clean Water Act.

A letter formally submitting this TMDL under Section 303(d) of the Clean Water Act was received on December 28, 2005.

Water Quality Standards Attainment

The water body's loading capacity for the applicable pollutant is identified and the rationale for the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources is described. TMDL and associated allocations are set at levels adequate to result in attainment of applicable water quality standards.

The loading capacity for Biological Oxygen Demand (BOD) and Ammonia are identified, and were determined using the QUAL2E water quality model. High BOD and Ammonia cause low Dissolve Oxygen (DO) in the receiving stream, which eliminates many aquatic organisms that require high levels of oxygen to survive. The Load capacity (LC) is defined as the greatest amount of loading of a pollutant that a waterbody can receive without violating water quality standards. This load is then divided among the point source (waste load allocation) and nonpoint source (load allocation) contributions to the stream, with an allowance for a margin of safety. Load Capacity = Waste Load Allocation + Load Allocation + Margin of Safety.

BOD and Ammonia loading resulting in violations of the Dissolved Oxygen (DO) criterion were modeled based upon meeting 5.0 mg/L DO in St. Francis River which, upon implementation of the WLA concentration-based permit limits, should result in attainment of both narrative and numeric water quality standards (WQS) for the protection of the Warm water Aquatic Life designated use.

Numeric Target(s)

Submittal describes applicable water quality standards, including beneficial uses, applicable numeric and/or narrative criteria. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression, site specific if possible, was developed from a narrative criterion and a description of the process used to derive the target is included in the submittal.

All WQS, criteria, and the beneficial uses: livestock and Wildlife Watering, Irrigation, Protection of Aquatic Life, Protection of Human Health associated with Fish Consumption, Cool Water Fishery, Whole Body Contact Recreation, and Boating and Canoeing, have been described. BOD and Ammonia are the parameters modeled to determine the impact the WWTP will have on DO levels in St. Francis River. The DO Water Quality Standard (WQS) criterion is a minimum of 5.0 mg/L for the St. Francis River. The seasonal Ammonia criteria was used from the standards at the typical seasonal pH and water temperature values (7.8 pH and 8°C winter and 26°C summer) are 1.2 mg/L (summer) and 2.0 mg/L (winter).

Numeric Target(s) and Pollutant(s) of concern

An explanation and analytical basis for expressing the TMDL through surrogate measures (e.g., parameters such as percent fines and turbidity for sediment impairments, or chlorophyll-a and phosphorus loadings for excess algae) is provided, if applicable. For each identified pollutant, the submittal describes analytical basis for conclusions, allocations and margin of safety that do not exceed the load capacity.

The water quality model QUAL2E generated the numeric link between DO, and BOD and Ammonia. Seasonal Ammonia criteria were targeted using temperature and pH per the MO WQS.

Source Analysis

Important assumptions made in developing the TMDL, such as assumed distribution of land use in the watershed, population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources, are described. Point, non point and background sources of pollutants of concern are described, including magnitude and location of the sources. Submittal demonstrates all significant sources have been considered.

Land use and soils are described as well as the history of the area. The controlling source of the impairment Farmington West Waste Water Treatment Plant (WWTP); NPDES permit number MO-0040312. St. Francis River is on the 2002-303(d) listed for low DO, and Ammonia.

Farmington Manor nursing home has a lagoon, which is the existing nonpoint source CBOD5 concentration in the tributary above the WWTP. In 2001, it was found that the CBOD5 was high as 6 mg/L in 2001 but were only 2 mg/L in the St. Francis River above the tributary. This may suggest a potential contribution from urban runoff. Like wise, NH3-N concentrations in the same period were as high as 0.12 mg/L in the tributary and non-detect in the St. Francis River. Because of the low flow in the tributary above the WWTP is zero, no load would be contributed and the LA is assigned as zero pounds per day.

Point Source Farmington West WWTF discharges wastewater into a 0.4 mile long unnamed tributary of the St. Francis River. The land use in the tributary is about 21% urban, 64% agricultural, and 15% forest. The current permit has a design flow of 2.4 million gallons per day (MGD) (about 3.72 cubic feet per second [ft³/S]) and contains the following effluent limits: BOD₅ 201.8 lbs/day and NH3 1.2 mg/L (summer) and 2.0 mg/L (winter), and a pH \geq 7.8 standard units. This permit expired May 4, 2005. All significant sources have been considered at this time.

Allocation

Submittal identifies appropriate wasteload allocations for point, and load allocations for nonpoint sources. If no point sources are present the wasteload allocation is zero. If no nonpoint sources are present, the load allocation is zero.

Allocations of St. Francis River, receives discharge from the Farmington West WWTP and Farmington Manor nursing home (lagoon system). The impaired segment's upstream end begins where the Farmington West WWTP tributary enters the river. Water quality data taken upstream of the tributary in the St. Francis River showed very low levels of nutrients and non-detectable in stream BOD, suggesting that the lagoon was either not discharging or the discharge was so small it was not having a discernable impact on in stream water quality. Since there was a very small CBOD5 and NH3-N loads from the Farmington Manor nursing home would be completely exhausted prior to entering the impaired segment of the river, no reduction in existing waste load was assigned. Non-discharging facilities are provided a LA of zero.

The QUAL2E model was calibrated to the simulation of flow, velocity, BOD, DO organic nitrogen, Ammonia nitrogen, nitrate, and nitrite nitrogen, within the range of measured data for these parameters. The WLA's for BOD, and Ammonia-N were derived from adjusting the plant discharge in the model to the full design flow of 3.72cfs. Because St. Francis is a Class P stream at the outfall, the effluent maintain its flow even during drought conditions allowed in Missouri WQS (MO 10CSR 20-7.031 (1) (F)). An additional test was done with the model with the application of winter conditions. The WLA concentrations are identified and will be incorporated into the Farmington West Waster Water Treatment Plant NPDES permit in the next permit reissuance.

WLA Comment

Waste load allocations (WLAs) for the Farmington West WWTP are as follows:

Load of 10 mg/L BOD5-equivalent to 201.8lbs/day

NH3-N (Ammonia as Nitrogen) is seasonal based upon summer and winter:

Summer: 2.0 mg/L NH3-N and 40.1 lbs/day

Winter: 2.5 mg/L NH3-N and 50.2 lbs/day

LA Comment

The existing nonpoint source CBOD5 concentrations in the tributary above the WWTP were as high as 6 mg/L in 2001 but were only 2 mg/L in the St. Francis River above tributary. NH3-N concentrations in the same period were high as 0.12 mg/L in the tributary and non-detect in the St. Francis River.

Load Allocation (LA) for non-point source is as follows: CBOD5-1.1 lbs/day, NH3-N-0 lbs/day.

Margin of Safety

Submittal describes explicit and/or implicit margin of safety for each pollutant. If the MOS is implicit, the conservative assumptions in the analysis for the MOS are described. If the MOS is explicit, the loadings set aside for the MOS are identified and a rationale for selecting the value for the MOS is provided.

The MOS is implicit based on conservative model assumptions and calculations. The limits for BOD, and NH3-N were derived from QUAL2E simulation that considered a background effluent DO concentration of 5 mg/L instead of the long term average of 5.5 mg/L.

Seasonal Variation and Critical Conditions

Submittal describes the method for accounting for seasonal variation and critical conditions in the TMDL(s).

Seasonal variation is taken into consideration for ammonia as nitrogen and a separate limit calculated for each summer and winter. Otherwise, the WWTP NPDES permit limits apply year long.

Public Participation

Submittal describes public notice and public comment opportunity, and explains how the public comments were considered in the final TMDL(s).

The Missouri Department of Natural Resources (MDNR) placed this TMDL on public notice from November 18, 2005 to December 18, 2005, on MDNR's state website. Groups which received the public notice announcement included the Missouri Clean Water Commission, Farmington West WWTP, the Water Quality Coordinating Committee, the St Francis County Soil and Water Conservation District, Stream Team volunteers in the watershed (31 people), the appropriate legislators(3), and others that routinely receive the public notice of Missouri State Operating Permits.

Monitoring Plan for TMDL(s) Under Phased Approach

The TMDL identifies the monitoring plan that describes the additional data to be collected to determine if the load reductions required by the TMDL lead to attainment of WQS, and a schedule for considering revisions to the TMDL(s) (where phased approach is used).

Instream monitoring sites were added to Farmington West's permit in January 2003. Since then, ambient water quality data has been gathered monthly by the facility in the St. Francois River both upstream and downstream of the tributary. The parameters that are being collected at these points are DO, BOD, pH, and temperature, NH₃-N, NO₃ + NO₂ as nitrogen, TKN, and total phosphorus. The next low flow studies will be in 2007 and 2008.

Reasonable assurance

Reasonable assurance only applies when reductions in nonpoint source loading is required to meet the prescribed waste load allocations.

The Waste Load Allocations are set to meet quality standards; no reasonable assurances are required of the Load Allocation because no reductions are required from NPS.